Molar Heat Capacity at Constant Volume of Trifluoromethane (R23) from the Triple-Point Temperature to 342 K at Pressures to 33 MPa

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Molar heat capacities at constant volume (C_v) of trifluoromethane (R23) have been measured with an adiabatic calorimeter. This calorimeter consists chiefly of a 5 cm ID spherical cell surrounded by a temperature-controlled adiabatic shield. The pulse method was employed in which energy was introduced during a 20 min pulse, while the initial and final temperatures were determined from drift rates which were measured before and after the heating pulse. Temperatures ranged from the triple point to 342 K, and pressures up to 33.5 MPa. Measurements were conducted on the liquid in equilibrium with its vapor and on compressed liquid and gaseous samples. The samples were of high purity, verified by chemical analysis. For the samples, calorimetric results were obtained for two-phase $C_v^{(2)}$, saturated-liquid C or C_x', and single-phase C_v molar heat capacities. The $C_v^{(2)}$ data were used to estimate vapor pressures for values less than 100 kPa by applying a thermodynamic relationship between the two-phase internal energy $U^{(2)}$ and the temperature derivatives of the vapor pressure. The triple-point temperature T_{tr} and the enthalpy of fusion $\Delta_{fus}H$ were also measured. The principal sources of uncertainty are the temperature rise measurement and the change-of-volume work adjustment. The expanded relative uncertainty (with a coverage factor k = 2 and thus a two-standard deviation estimate) for C_v is estimated to be 0.7%, for $C_v^{(2)}$ it is 0.5 %, and for C_σ it is 0.7%.